FIROUZI CONSULTING ENGINEER, INC.

SKYTRON SURGICAL PRODUCTS	DES.		SHEET
SPECTRA SERIES - ST9W FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	FCE JOB No.		**1**
	DATE: 6 – 21 – 03		OF 7 SHEETS

SEISMIC ANCHORING BOLT DESIGN
ST9W
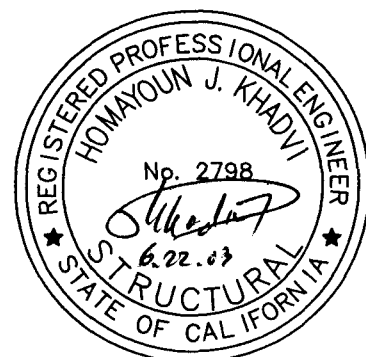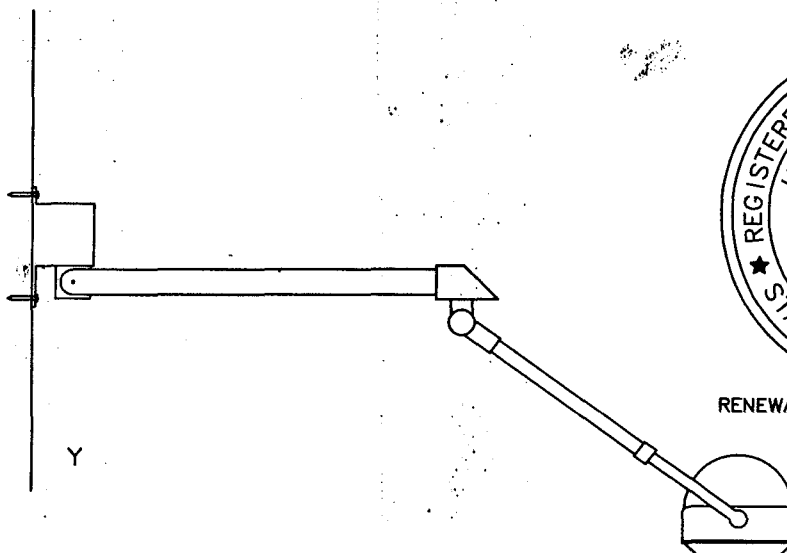
RENEWAL FEE DUE DATE: 06-30-06

ELEVATION

NOTES:

1. SCOPE OF WORK: DESIGN OF BOLTS CONNECTING MOUNTING PLATE TO STRUCTURE ONLY.

2. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE – SECTION 1632A, (INCLUDING UP TO DATE REVISIONS) AND HAVE BEEN FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE

3. FORCES ARE MAXIMUMS AND OCCUR WHEN EQUIPMENT IS MOVED TO ITS MOST ECCENTRIC POSITION.

4. PROVIDE WALL STRUCTURE DESIGNED AND DETAILS TO SUPPORT WEIGHTS AND FORCES SHOWN (BY ENGINEER OF RECORD FOR THE BUILDING)

5. ENGIINEER OF RECORD TO DESIGN, DETAIL AND VERIFY STRUCTURE AND/ OR EXISTING. LIGHT SUPPORT TRACTS TO SUPPORT INDICATED LOADS

6. HORIZONTAL FORCES AND MOMENT MAY OCCUR IN ANY DIRECTION, ACTING AT THE TOP OF MOUNTING PLATE.

FIROUZI CONSULTING ENGINEER, INC.

DESIGN CRITERIA:

FORMULA 32A-1: $F_P = 4.0\, Ca*Ip*Wp$

TABLE 16A-Q : $Ca = 0.44*Na = 0.44*1.5 = 0.66$ (For zone 4 & S_D)

TABLE 16A-K : $Ia = 1.5$ (For essential facility)

$\therefore F_P = (4.0)(0.66)(1.5)Wp = 3.96\, Wp$ (For LRFD)

$F_P = 3.96Wp/1.4 = 2.83Wp$ (For ASD)

FORMULA 30A-1: $E = p*E_h + E_v$
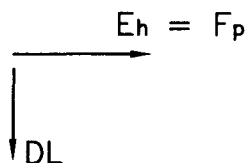
$E_h = F_P$

$p = 1.0$ (FOR COMPONENT)

$E_v = (0.5)Ca*Ip*Wp$
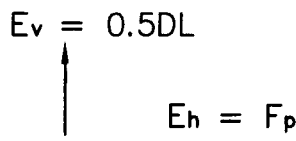
$= (0.5)(0.66)(1.5)Wp = 0.5Wp$ (For LRFD)

$= 0$ (For ASD)

SECTION 1630A.11: $E_v = (0.7)Ca*I*Wp$

$= (0.7)(0.66)(1.5)/1.4 = 0.5Wp$ (For ASD) [NET UPLIFT FORCE]

LOAD COMBINATION CASE A

$E_h = F_p$

DL

LOAD COMBINATION CASE B

$E_v = 0.5DL$

$E_h = F_p$

BY COMPARISION LOAD, COMBINATION A GOVERNS

FIROUZI CONSULTING ENGINEER, INC.

CASE I
X=73, Y=0, Z=0

SIDE VIEW

CASE II
X=31.5, Y=0, Z=41.5

SIDE VIEW

t: Direct tension/bolt
t': Flexual tension/bolt
m: Momment/bolt
c': Flexual compression/bolt
S: Shear/bolt

CASE I

$V_d = 33$ #
$D_y = 4.75$ "
$D_z = 9$ "
$X = 73$ "
$Z = 0$ "
$Y = 0$ "
$V_e = 0.50 \times 33 = 16.3$ #
$H_e = 2.83 \times 33 = 93.3$ #
$t = 93.3 / 4 = 23.3$ #
$S_z = (33 + 16.3)/4 = 12.3$ #
$S_y = 93.3 / 4 = 23.3$ #
$S = (S_y^2 + S_z^2)^{0.5} = 26.4$ #
Total $M_{xx} = (33 + 16.3) \times 0 + 93.3 \times 0 = 0$ "#
$S' = 0 /(5.1 \times 4) = 0$ #
Total $M_{yy} = (33 + 16.3) \times 73 + 93.3 \times 0 = 3601$ "#
$t' = 3601 /(9 \times 2) = 200$ #

CASE II

$V_d = 33$ #
$D_y = 4.75$ "
$D_z = 9$ "
$X = 31.5$ "
$Z = 41.5$ "
$Y = 0$ "
$V_e = 0.50 \times 33 = 16.3$ #
$H_e = 2.83 \times 33 = 93.3$ #
$t = 93.3 / 4 = 23.3$ #
$S_z = (33 + 16.3)/4 = 12.3$ #
$S_y = 93.3 / 4 = 23.3$ #
$S = (S_y^2 + S_z^2)^{0.5} = 26.4$ #
Total $M_{xx} = (33 + 16.3) \times 0 + 93.3 \times 41.5 = 3874$ "#
$S' = 3874 /(5 1 \times 4) = 190.3$ #
Total $M_{yy} = (33 + 16.3) \times 31.5 + 93.3 \times 41.5 = 5428$ "#
$t' = 5428 /(9 \times 2) = 302$ #

FIROUZI CONSULTING ENGINEER, INC.

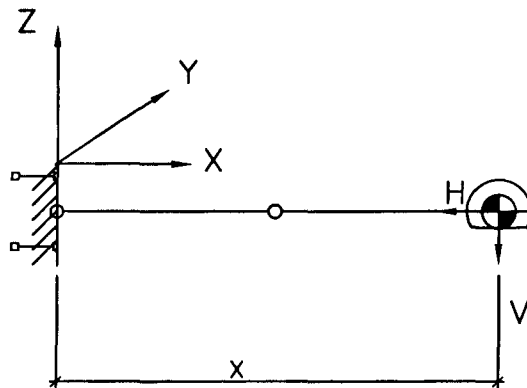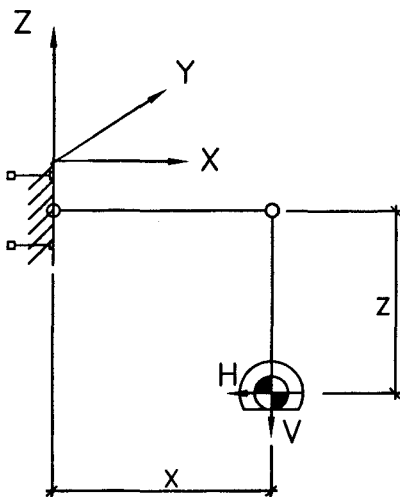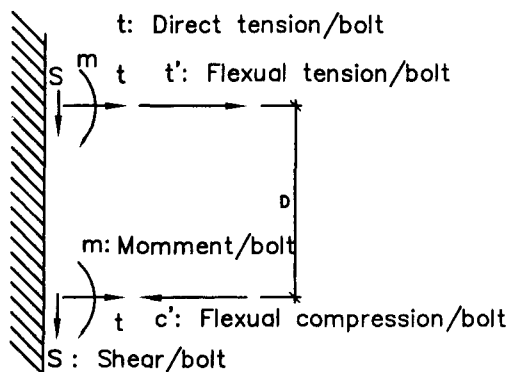| SKYTRON SURGICAL PRODUCTS	DES.		SHEET
SPECTRA SERIES - ST9W FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	FCE JOB No. DATE: 6 − 21 − 03		**4** OF 7 SHEETS

CASE III

$Vd = 33 \#$

$Dy = 4.75 "$

$Dz = 9 "$

$X = 0 "$

$Z = 0 "$

$Y = 73 "$

$Ve = 0.50 \times 33 = 16.3 \#$

$He = 2.83 \times 33 = 93.3 \#$

$t = 93.3 / 4 = 23.3 \#$

$Sz = (33 + 16.3)/4 = 12.3 \#$

$Sy = 93.3 / 4 = 23.3 \#$

$S = (Sy^2+Sz^2)^{0.5} = 26.4 \#$

Total $Mxx = (33 + 16.3) \times 73 + 93.3 \times 0 = 3601 "\#$

$S' = 3601 /(5.1 \times 4)= 176.9 \#$

Total $Myy = (33 + 16.3) \times 0 + 93.3 \times 0 = 0 "\#$

$t' = 0 /(9 \times 2) = 0 \#$

CASE III
X=0, Y=73", Z=0

CASE IV

$Vd = 33 \#$

$Dy = 4.75 "$

$Dz = 9 "$

$X = 31.5 \times SIN(45) = 22.3 "$

$Z = 41.5 "$

$Y = 31.5 \times COS(45) = 22.3 "$

$Ve = 0.50 \times 33 = 16.3 \#$

$He = 2.83 \times 33 = 93.3 \#$

$t = 93.3 / 4 = 23.3 \#$

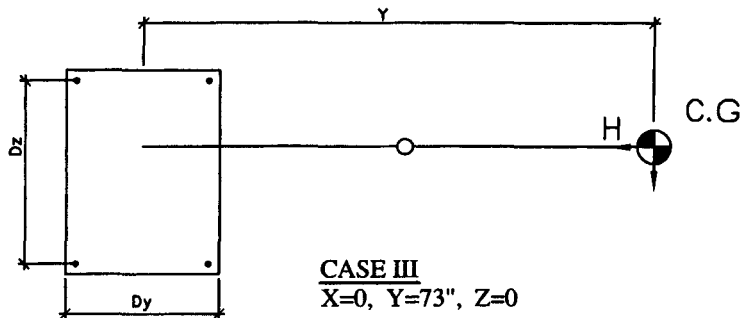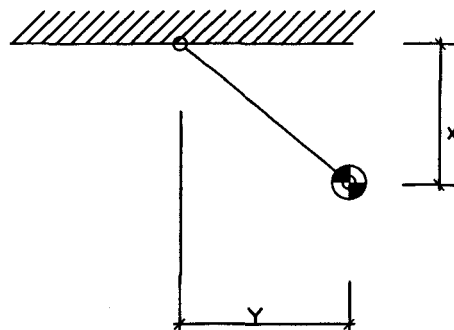$Sz = (33 + 16.3)/4 = 12.3 \#$

$Sy = 93.3 / 4 = 23.3 \#$

$S = (Sy^2+Sz^2)^{0.5} = 26.4 \#$
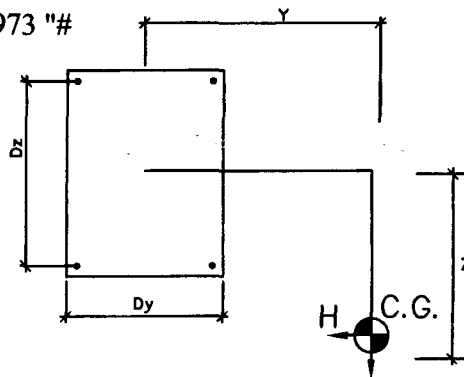
Total $Mxx = (33 + 16.3) \times 22.3 + 93.3 \times 41.5 = 4973 "\#$

$S' = 4973 /(5.1 \times 4)= 244.3 \#$

Total $Myy = (33 + 16.3) \times 22.3 + 93.3 \times 41.5 = 4973 "\#$

$t' = 4973 /(9 \times 2) = 276 \#$

CASE IV
X=31.5*SIN(45)
Y=31.5*COS(45)
Z=41.5

FIROUZI CONSULTING ENGINEER, INC.

SKYTRON SURGICAL PRODUCTS	DES.		SHEET
SPECTRA SERIES - ST9W FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	FCE JOB No. DATE: 6 – 21 – 03		**5** OF 7 SHEETS

CASE V
$V_d = 33$ #
$D_y = 4.75$ "
$D_z = 9$ "
$X = 73 \times SIN(45) = 51.6$ "
$Z = 0$ "
$Y = 73 \times COS(45) = 51.6$ "
$V_e = 0.50 \times 33 = 16.3$ #
$H_e = 2.83 \times 33 = 93.3$ #
$t = 93.3 / 4 = 23.3$ #
$S_z = (33 + 16.3) / 4 = 12.3$ #
$S_y = 93.3 / 4 = 23.3$ #
$S = (S_y{}^2 + S_z{}^2)^{0.5} = 26.4$ #
Total $M_{xx} = (33 + 16.3) \times 51.6 + 93.3 \times 0 = 2547$ "#
$S' = 2547 / (5.1 \times 4) = 125.1$ #
Total $M_{yy} = (33 + 16.3) \times 51.6 + 93.3 \times 0 = 2547$ "#
$t' = 2547 / (9 \times 2) = 141$ #

CASE V
$X=73*SIN(45), \ Y=73*COS(45), \ Z=0$

CASE VI
$V_d = 33$ #
$D_y = 4.75$ "
$D_z = 9$ "
$X = 41.5$ "
$Z = 0$ "
$Y = 31.5$ "
$V_e = 0.50 \times 33 = 16.3$ #
$H_e = 2.83 \times 33 = 93.3$ #
$t = 93.3 / 4 = 23.3$ #
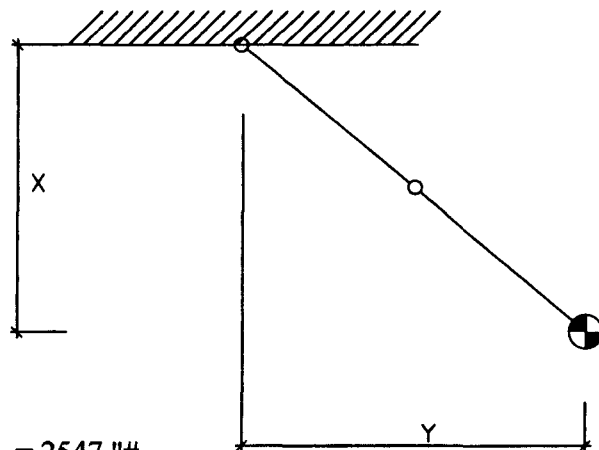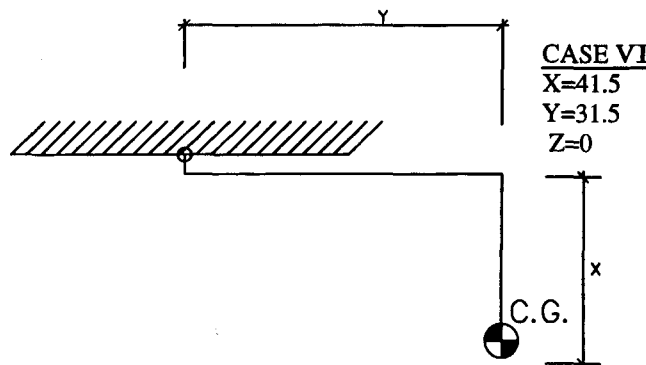$S_z = (33 + 16.3) / 4 = 12.3$ #
$S_y = 93.3 / 4 = 23.3$ #
$S = (S_y{}^2 + S_z{}^2)^{0.5} = 26.4$ #
Total $M_{xx} = (33 + 16.3) \times 31.5 + 93.3 \times 0 = 1554$ "#
$S' = 1554 / (5.1 \times 4) = 76.4$ #
Total $M_{yy} = (33 + 16.3) \times 41.5 + 93.3 \times 0 = 2047$ "#
$t' = 2047 / (9 \times 2) = 114$ #

CASE VI
X=41.5
Y=31.5
Z=0

C.G.

FIROUZI CONSULTING ENGINEER, INC.

SKYTRON SURGICAL PRODUCTS	DES.		SHEET
SPECTRA SERIES - IN9WEL	FCE JOB No.		**7**
FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	DATE: 6 – 21 – 03		OF 7 SHEETS

CHECK 1/2" DIA. A307 BOLTS:

ALLOWABLE TENSION: 3,000 #
ALLOWABLE SHEAR: 2,000 #

$S = 3.14 * d^3/32 = 3.14 \times (0.5)^3 / 32 = 0.01 \text{ "}3$
$fb = 16.3 / 0.01 = 1331 \text{ PSI}$
$Fb = 0.75 \times 36000 = 27000 \text{ PSI}$

$fv/Fv + ft/Ft + fb/Fb = 0.17 + 0.13 + 0.05 = 0.34 < 1.0$ OK

USE 1/2" DIA. A307 THREADED RODS

FIROUZI CONSULTING ENGINEER, INC.

SKYTRON SURGICAL PRODUCTS	DES.		SHEET
SPECTRA SERIES - ST9W FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	FCE JOB No. DATE: 6 − 21 − 03		**6** OF 7 SHEETS

CASE VII
$Vd = 33\ \#$
$Dy = 4.75\ "$
$Dz = 9\ "$
$X = 31.5\ "$
$Z = 0\ "$
$Y = 41.5\ "$
$Ve = 0.50 \times 33 = 16.3\ \#$
$He = 2.83 \times 33 = 93.3\ \#$
$t = 93.3\ / 4 = 23.3\ \#$
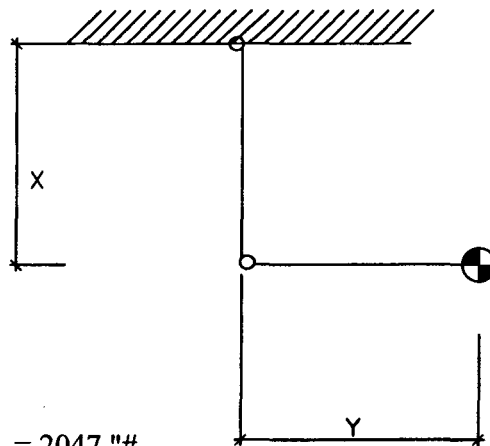$Sz = (33 + 16.3)/ 4 = 12.3\ \#$
$Sy = 93.3\ / 4 = 23.3\ \#$
$S = (Sy^2+Sz^2)^{0.5} = 26.4\ \#$
Total $Mxx = (33 + 16.3) \times 41.5 + 93.3 \times 0 = 2047\ "\#$
$S' = 2047\ /(5.1 \times 4) = 100.6\ \#$
Total $Myy = (33 + 16.3) \times 31.5 + 93.3 \times 0 = 1554\ "\#$
$t' = 1554\ /(9 \times 2) = 86\ \#$

CASE VIII
$Vd = 33\ \#$
$Dy = 4.75\ "$
$Dz = 9\ "$
$X = 0\ "$
$Z = 73\ "$
$Y = 0\ "$
$Ve = 0.50 \times 33 = 16.3\ \#$
$He = 2.83 \times 33 = 93.3\ \#$
$t = 93.3\ / 4 = 23.3\ \#$
$Sz = (33 + 16.3)/ 4 = 12.3\ \#$
$Sy = 93.3\ / 4 = 23.3\ \#$
$S = (Sy^2+Sz^2)^{0.5} = 26.4\ \#$
Total $Mxx = (33 + 16.3) \times 0 + 93.3 \times 73 = 6814\ "\#$
$S' = 6814\ /(5.1 \times 4) = 334.8\ \#$ GOVERNS
Total $Myy = (33 + 16.3) \times 0 + 93.3 \times 73 = 6814\ "\#$
$t' = 6814\ /(9 \times 2) = 379\ \#$ GOVERNS

CASE VII
X=31.5, Y=41.5, Z=0